

Synopsys of Proposed work for Ph.D.

on

“Design & Development of Zero Pollution Air Engine”

By

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Synopsis of Proposed work for Ph.D.

1. Area / Specialization of Research Work: -“Energy Conversion”
2. Topic of Research Work: - “Design & development of zero pollution air engine”
3. Introduction: -

It is worldwide burning problem to find out best alternatives of fuel oil & to make sustainable energy future. The current study made in the year 2004, predicts that if the oil is consumed at the current rates, then by 2020, we will be consuming 80% of the entire available resource. This necessitates the search for alternative of oil as energy source or preserving it by tapping some other alternatives such as non-conventional energy sources, battery operated vehicles, photocells etc. and to convert their output into mechanical energy, which may alternatively preserve oil source.

The worldwide researches are also going on for other alternatives such as use of Hydrogen Fuel Cell (which is presently very costly), use of bio-diesel or use of compressed air vehicle engines which may be made of light material. Work on compressed air engines are in progress since 1979. “Guy Negre”, a French Scientist developed compressed air 4-cylinders engine run on air and gasoline, for car in 1998 and got 52-patents registered so far. The 4- cylinders engine thus developed run on both air and gas together. The concept of micro or mini compressed air engine can be one of the best alternatives for light vehicles, if it runs using air alone and thus causing no pollution.

Main aim of present research work is to design micro compressed air turbines and develop it for functional use as air engine. It shall require design and development of micro impulse / reaction turbines which can run on compressed air and convert compressed air energy to shaft work for producing adequate torque. This will definitely be zero pollution / emission free air engine. Air is a natural resource that can be compressed at filling stations and cylinders of smaller size with lightweight can be filled at filling stations.

4. Methodology: -

- Literature survey in respect to design and development of mini/micro air turbines, compressed air tools / engines etc.
- Identification and study of requirements for small capacity two wheeler automobile engine.
- Design of air turbine for small capacity compressed air engine.
- Design of portable compressed air storage device.
- Development of air turbine and compressed air storage device.
- Development of complete compressed air engine and its utilization in two wheeler vehicle.
- Testing of two wheeler vehicle running on compressed air engine and comparative study of its performance with existing petrol run vehicle.
- Preparation of thesis report and its submission.

5. Brief Review of the Work: -

In present day civilization the need of transport has become essential part of life and the transportation requirements are becoming severe with the increasing population. With the increasing transportation requirement the demand of fossil fuel is also increasing day by day at very fast rate.

This has created panic to go for alternative fuel and preserve the sustainable energy source. Most of researches are going on and Hydrogen cell cars are developed, but they are not cost effective. The bio diesel studies are also going on but it has its' own limitations as it is to be blended with existing fuel up to the maximum of 20 % blending. Other natural energy sources are also being tapped like photocell power stations, or battery operated vehicles etc.

Studies are also going on for compressed air turbines. Wind Mills, Compressed air tools such as pneumatic cutter, hammer etc are also run on compressed air with high RPM rotors based on principle of turbine.

The present research work is aimed to design compressed air engine based on micro turbine which could be used for small capacity two wheeler engine. Use of such type of engine can also be extended to the light vehicle as these would run without any fuel and compressed air can be conveniently filled at various stations. The vehicle can have small compressed air storage cylinder, which can be filled and used for running the vehicle. Such vehicle will definitely be zero pollution vehicle.

6. Schedule of Activities: -

The proposed work will continue as follows: -

6.1 Literature Review	-6 months
6.2 Design of compressed air turbine	-8 months
6.3 Fabrication of compressed air engine	-8 months
6.4 Experimentation, Results & Discussions	-8 months
6.5 Thesis writing	-6 months

7. Impact of proposed research work in Academics / Industry

Keeping in view of higher rates of fuel consumption fast depleting fossil fuel reserves, it is inevitable to go for alternative fuel, fuel mixtures or some other energy source to overcome future problems when all the resources of fossil fuel will get exhausted. Proposed research aims at developing an engine run on compressed air. Major advantage from such compressed air engine is in terms of fuel which is natural air and can be had at no price. *An engine run purely on this compressed air will be free from pollution and thus a great contribution to society.*

8. Addresses of related web sites:-

- 8.1 <http://www.usfcc.com>
- 8.2 http://www.oilcrash.com/articles/natnl_01.htm
- 8.3 <http://www.fueleconomy.gov>
- 8.4 <http://www.peakoil.net>
- 8.5 <http://www.solaraccess.com>
- 8.6 <http://www.efcf.com/reports>
- 8.7 <http://www.epa.gov>
- 8.8 <http://www.energy.ca.gov/energypolicy/index.html>
- 8.9 <http://www.zeropollution.com/zeropollution/index.html>
- 8.10 <http://www.aircaraccess.com>
- 8.11 <http://www.philippines.hvu.nl/transport3.htm>
& <http://www.luxfurcylinder.com>
- 8.12 <http://www.mdi.lu>
- 8.13 <http://www.theaircar.com>

9. Major Inputs

All facilities available in the **Sagar Institute of Engg. & Management, Barabanki** will be used for research.

10. Up-to-date References

10.1 -Peter Fuglsang- "Design and Verification of the Ris0-B1 Airfoil family for Wind Turbines"- ASME-Nov'2004

10.2 - Michel S. Selig- "Wind Tunnel Aerodynamics Tests of Six Airfoils for use on Small Wind Turbines" -ASME-Nov'2004

10.3 -Rama Subba Reddy Gorla- "Probabilistic Heat Transfer and Structural Analysis of Turbine Blade" -International Journal of Turbo and Jet Engines, 22, 1-11(2005)

10.4 - S. Schreck & M. Robinson- "Tip Speed Ratio Influences on Rationally Augmented Boundary Layer Topology & Aerodynamic Force Generation" -Journal of Solar Energy Engg.-ASME-Nov'2004

10.5 - G.J.W. Van Bussel- "Aerodynamic Research on Tipvane Wind Turbines" - National Technical Information Service, Springfield, Va. 22161

10.6 - K. Aleklett and C.J. Campbell- "The Peak and Decline of World Oil and Gas Production" – Oil Production, Feb.2004

10.7 – ABI Research- "Wind Turbines" – Market Wire, NY, 03/16/2004

10.8 – Robert Rose, William Vincent- "Fuel Cell Vehicle World Survey 2003"-Breakthrough Technologies Institute, Washington, D.C. 20006-February'2004

10.9 – Guy and Cyril Negre- "Compressed Air: The Most Sustainable Energy Carrier for Community Vehicles" – Speech in front of assembly at Kultur gathered for "Fuel Cells World" Tuesday 29th June'2004

11. Chapter Scheme: - (Tentative)

Chapter I: - Introduction

Chapter II: - Literature review

Chapter III: - Design of compressed air engine

Chapter IV: - Development of compressed air engine

Chapter V: - Performance testing of compressed air engine

Chapter VI: -Results and discussions

Chapter VI: - Conclusions and suggestions for future work

12. Bibliography: -

12.1 - K. Aleklett and C.J. Campbell- "The Peak and Decline of World Oil and Gas Production" – Oil Production, Feb.2004

12.2 – A.F. Alhajji and James L. Williams- "Measure of Petroleum Dependence and Vulnerability in OECD Countries" Middle East Economic Surveys (MEES 46:16, April 21, 2003)

12.3 – Bossel, Ulf, Baldur Eliasson, Gordon Taylor – "The Future of Hydrogen Economy: Bright or Break? – Fuel Cell Seminar-2003, 3-7 November'2003

12.4 – ABI Research- "Wind Turbines" – Market Wire, NY, 03/16/2004

12.5- Alec N. Brooks- "Prospective on Fuel Cell and Battery Electric Vehicles" –AC Propulsion, CARB ZEV Workshop-December 5, 2002

12.6 – R. S. Foss- "Managing Compressed Air Energy" – http://www.mt-online.com/current/0801_mngcompressedair.html- (accessed on 5th November, 2002)

12.7 – R. Baxter- "Energy Storage: enabling a future for renewable?"- http://www.xj.com/magsandj/rew/2002_04/energy_storage.html - (accessed 13th January, 2003)

12.8 – Arnold Schwarzenegger, Governor- "Transportation Fuel, Technology and Infrastructure Assessment Report" – California Energy Commission-December 2003-100-03-013F

12.9 – Robert Rose, William Vincent- “Fuel Cell Vehicle World Survey 2003”-Breakthrough Technologies Institute, Washington, D.C. 20006-February’2004

12.10 – Guy and Cyril Negre- “Compressed Air: The Most Sustainable Energy Carrier for Community Vehicles” – Speech in front of assembly at Kultur gathered for “Fuel Cells World” Tuesday 29th June’2004

12.11 -Peter Fuglsang, Christian Bak - “Development of the Ris0 Wind Turbine Airfoils”- Journal Wind Energy-Vol. 7-2004- Pages 145-162

12.12 -Peter Fuglsang, Christian Bak - “Design and Verification of the Ris0-B1 Airfoil family for Wind Turbines”-Journal of Solar Energy Engg. -ASME-Vol. 126 - Nov’2004 - Pages 1002-1010

12.13 - Paul Migliore and Stefan Oerlemans- “Wind Tunnel Aerodynamics Tests of Six Airfoils for use on Small Wind Turbines” - Journal of Solar Energy Engg. - ASME-Vol. 126, Nov’2004-Pages 974 - 985.

12.14 - Michel S. Selig and Bryan D McGranahan - “Wind Tunnel Aerodynamics Tests of Six Airfoils for use on Small Wind Turbines” – Journal of Solar Energy Engg. -ASME-Vol. 126, Nov’2004-Pages 986-1001.

12.15 -Rama Subba Reddy Gorla- “Probabilistic Heat Transfer and Structural Analysis of Turbine Blade” -International Journal of Turbo and Jet Engines, 22, 1-11(2005)

12.16 -S. Schreck & M. Robinson- “Tip Speed Ratio Influences on Rationally Augmented Boundary Layer Topology & Aerodynamic Force Generation” -Journal of Solar Energy Engg.-ASME-Nov’2004

12.17 - G.J.W. Van Bussel- “Aerodynamic Research on Tip vane Wind Turbines” -National Technical Information Service, Springfield, Va. 22161

12.18 - BP Patel, GVR Murthy and SS Gupta- “Thermo-Elastic Stability Characteristics of Laminated Non-Circular Cylindrical Shells Using Higher Order Theory” – Journal of Aerospace Sciences and Technology, Vol. 56 No.1 Pages 1-14 (Accepted on 27 Feb 2004)

12.19 – SS Gupta, BP Patel, KN Khatri, M Ganapathi, CT Sambandam and SN Giri- “Asymmetric Dynamic Buckling of Isotropic / Anisotropic Spherical Caps” - Journal of Aerospace Sciences and Technology, Vol. 56 No.1 Pages 15-25 (Accepted on 27 Jan 2004)

12.20 – Oerlemans S and Migliore P – “Aeroacoustic Wind Tunnel Test of Wind Turbine Airfoils- AIAA-2004-3042

13. PERT Chart: -

Activity	6-Months	16-Months	8-Months	6-Months	
A					Literature Review
B					Design & Dev. of Air Engine
C					Experimentation & Results
D					Thesis Writing

Dr. Onkar Singh
Supervisor

(BR Singh)